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Comparison of road freight transport trends in Europe. Coupling and decoupling factors from an Input–Output structural decomposition analysis

Ana Alises *, José Manuel Vassallo [1]

Transport Research Centre (TRANSYT), Universidad Politécnica de Madrid, E.T.S.I. Caminos, Canales y Puertos, Avda. Profesor Aranguren s/n, Ciudad Universitaria, 28040 Madrid, Spain

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ABSTRACT

Decoupling road freight transport from economic growth has been acknowledged by the European Union as a key means to improving sustainability. It is therefore important to identify both the coupling and decoupling drivers of road freight transport demand in order to determine possible factors that may contribute to reduce road transport in the future without curbing economic development. This research proposes an Input–Output (IO) structural decomposition analysis (SDA) to explain road freight transport in terms of a set of key factors that have strongly influenced road freight demand in recent decades in European countries—such as economic growth, economic structure and the evolution of road transport intensity (including improvements in both supply and transport systems). This methodological approach allows us to quantify and compare their contribution in different European countries to either increase or decrease road freight transport demand. The empirical basis for this analysis is a dataset of nine European countries which have IO tables and road transport data available from 2000 to 2007, comprising data on domestic production, imports and exports as well as tonne-kms for 11 types of commodity classes. The results show that, as a whole, aggregate road transport demand has grown—driven mainly by economic activity—but this growth has been strongly curbed in some countries by changes in road freight transport intensity and moderately by the dematerialization of the economy. International transport has been also proven to be a key factor driving road freight transport volumes. Moreover, the increased penetration of foreign operators in national haulage markets appears to have reinforced the final decoupling levels observed in some cases.

1. Introduction

Transport is essential for economic development, but it is also responsible for a wide variety of externalities. Past trends indicate that for decades the European transport system has been moving away from sustainability hence causing environmental and social problems. Specifically, in the last decade transport has accounted for around a third of all final energy consumption in the European Union (EU) countries, and more than a fifth of greenhouse gas emissions. Moreover, road

* Corresponding author. Tel./fax: +34 913365259.
E-mail addresses: ana.alises@upm.es (A. Alises), josemanuel.vassallo@upm.es (J.M. Vassallo).
[1] Tel.: +34 91336 6655; fax: +34 913366656.

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transport, the most energy and carbon intensive transportation mode, has become the dominant mode within Europe, ranking the highest share of inland freight in 2007 with nearly 80% in EU-27.

In this scenario there is an urgent need for actions aimed at reaching transport sustainability targets at both the national and European levels. The challenge, taken up by the EU, is to increase transport efficiency through the full internalisation of the negative side-effects of transport (European Commission, 2001a). To that end, the EU has promoted a number of policy measures to reduce road freight transport-related externalities (European Commission, 2003). One of the key tools for accomplishing this goal is to promote the decoupling of road transport growth from economic development (OECD, 2006).

Decoupling means to undo the traditional link between economic growth and road transport activity. This concept has been widely discussed in policy reports. It was the focus of the Standing Advisory Committee on Trunk Road Assessment (SACTRA) report in the United Kingdom in 1999, and has also been addressed in political documents such as the European White Papers entitled "European Transport Policy for 2020: Time to Decide" (European Commission, 2001b) and "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system" European Commission, 2011).

Within this context, over the last few decades decoupling has been partly taking place in some countries since they are making the transition to more service-oriented economies, and thus their economic growth has become progressively detached from road transport demand. Other sectors such as agriculture or mining demand more tonne-kms for their production processes than service sectors. As services have expanded their share of total GDP, this has led to higher economic growth than in the transport sector (Åhman, 2004).

Transport demand derives from economic activity, and the restructuring of the economy may lead to changes in the goods produced and moved, and in transport requirements. Specifically, freight activity is driven by complex and interlinked production processes and trade relationships. Recent years have seen globalisation trends, increasing specialisation, new production organisation systems such as 'just-in-time' distribution, and an ever greater concentration of manufacturing and storage (McKinnon and Woodburn, 1996). All these factors lead to changes in transport patterns, as supply chain organisation influences both transport distances and modal split (OECD, 2006).

As the evolution of all these variables may explain road freight transport trends and affect road sector in a different way in European countries, this research aims to meet four objectives:

(1) The main goal is to identify the key factors driving road freight transport in recent decades in Europe. Through an IO structural decomposition analysis (SDA) we will break down road freight tonne-kms changes over time into the contributions of the key variables that have strongly influenced road freight transport demand in European countries. It will allow us to identify the factors that have played the greatest role in defining road transport trends.
The decomposing method has been already applied in previous research works to analyse transport trends in some countries (see e.g. Kveiborg and Fosgerau, 2007 and Sorrell et al., 2012). Our research intends to combine this methodology with the IO model in order to incorporate the structure of the economy realistically in this type of analysis. It is noted that although IO techniques have been used in the past to develop road transport models (see e.g. Cascetta et al., 1996), neither this type of framework nor SDA analysis have ever been applied to explain and compare transport trends at the macro-level. In the light that SDA technique has already been used to explain energy consumption (e.g. Alcántara and Duarte, 2004, Wachsmann et al., 2009 and Lin and Polenske, 1995), and atmospheric pollution trends (e.g. Roca and Serrano, 2007), we consider that it may also be useful in this subject of transportation literature.
(2) Provide an EU-level cross-country comparison of the results for different European Member States. We will look at similarities and differences between road freight transport trends in Europe and in the way different explanatory factors have impacted on their road freight transport. It will allow us to identify the countries that have achieved significant decoupling levels and the main reasons for this situation.
(3) Confront our EU-level comparative results with findings from individual countries of previous research works dealing with decoupling. Most previous studies have analysed road transport trends only for a single country—often with a focus on the micro-level, whilst our paper aims to provide a homogenous macro-analysis for different European countries using the same type of data for all of them. Our results can be then compared with previous research works in order to show similarities or differences.
(4) Analyse the impact of decoupling trends observed in some countries in the road transport industry of the EU countries in terms of profitability and organisation.

Accordingly, this paper is structured as follows. In Section 2 we describe the methodology and define the components explaining road freight transport demand. In Section 3 we develop our empirical application. In Subsection 3.1 we apply the methodology to measure the contributions of the several coupling and decoupling factors in nine EU countries. In Subsection 3.2 we develop a cross-country comparison pointing out the main similarities and divergences among these countries. We also compare our results with previous research works in this field. In addition, Subsection 3.3 provides a discussion of the effects of the decoupling trends in the road industry. Finally, Section 4 ends with some conclusions and highlights about the future research needs in this area. We also include two appendices: the first contains the mathematical expressions applied to obtain the structural decomposition equation; and the second, all the data resulting from the analysis by country and economic sector.